

## MULTIDISCIPLINARY SYMPOSIUM: COLORECTAL CANCER

# Lower gastrointestinal tract tumours: diagnosis and staging strategies\*

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### Abstract

In patients with colorectal cancer, accurate assessment of tumour extent within and beyond the bowel wall and detection of lymph node and distant metastases are of paramount importance in planning the surgical approach, in deciding whether neo-adjuvant chemotherapy or radiation therapy is necessary, and in determining the risk of tumour recurrence and overall prognosis. The utility of MDCT, MR, transrectal ultrasound, PET, PET/CT is discussed and recommendations for cost-effective imaging in these patients are presented.

**Keywords:** Colon CT; colon MR; colon ultrasound; colon cancer; colon cancer staging.

### Introduction

Colorectal cancer is the third leading cause of cancer worldwide, accounting for nearly 10% of the estimated 700 000 000 invasive cancers occurring annually. There is substantial international variation in incidence rates but these tumours are most prevalent in North America, Europe, and other areas of the world with similar lifestyles and dietary habits. Despite an improved understanding of the development of colorectal cancer and the technical ability to alter its natural history in a large proportion of average and high-risk patients, this cancer remains deadly. Earlier detection of polyps and cancer, aggressive surgery for the primary tumour, and improved multimodality treatment for metastatic disease can improve the prognosis of this neoplasm<sup>[1–5]</sup>.

day. Questions to be answered include: who to screen? how to screen? how often to screen? when to begin screening? what is the size of the precursor lesion to be targeted?

**Table 1** TNM staging system for colorectal cancer

0	Tis	N0	M0
I	T1, T2	N0	M0
II	T3, T4	N0	M0
III	Any T	N1, N2	M0
IV	Any T	Any N	M1

There are a number of screening techniques available for detecting cancers and polyps of the colorectum (Fig. 1):

- (1) faecal occult blood test
- (2) flexible sigmoidoscopy
- (3) air contrast barium enema

### Screening and diagnosis

The screening for colorectal cancer is one of the most important and controversial public health issues of the

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**Figure 1** Colorectal cancer detection. The three major radiologic methods are the air contrast barium enema (A), CT colonography (B), and MR colonography (C).

- (4) optical colonoscopy
- (5) computed tomography (CT) colonography
- (6) magnetic resonance (MR) colonography.

Since complete visualization of the colon is necessary, the faecal occult blood test and flexible sigmoidoscopy are inadequate examinations. The art of the air contrast barium enema is rapidly fading because of referral patterns and lack of interest. CT and MR colonography appear poised to become competitive with optimal colonoscopy without the need for sedation and only minimal risk of perforation. With developments in faecal tagging, computer aided detection (CAD) and electronic cleansing, CT colonography may become the primary screening test for average risk patients because a rigorous cathartic will not be necessary.

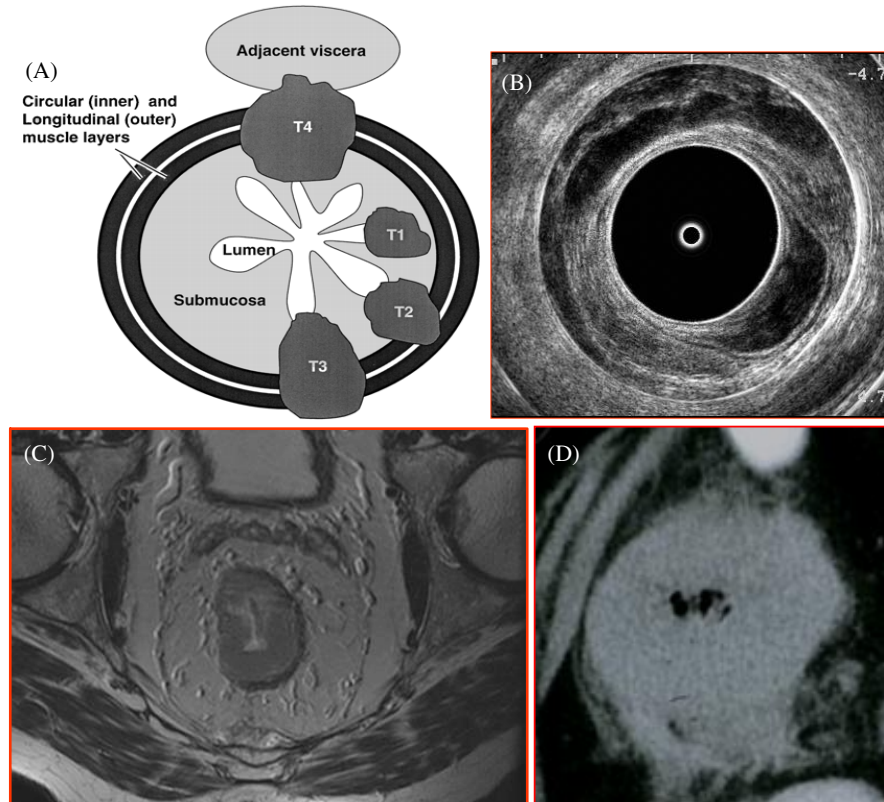
### Staging

Once the diagnosis of colorectal cancer has been established by whatever method, accurate staging is of

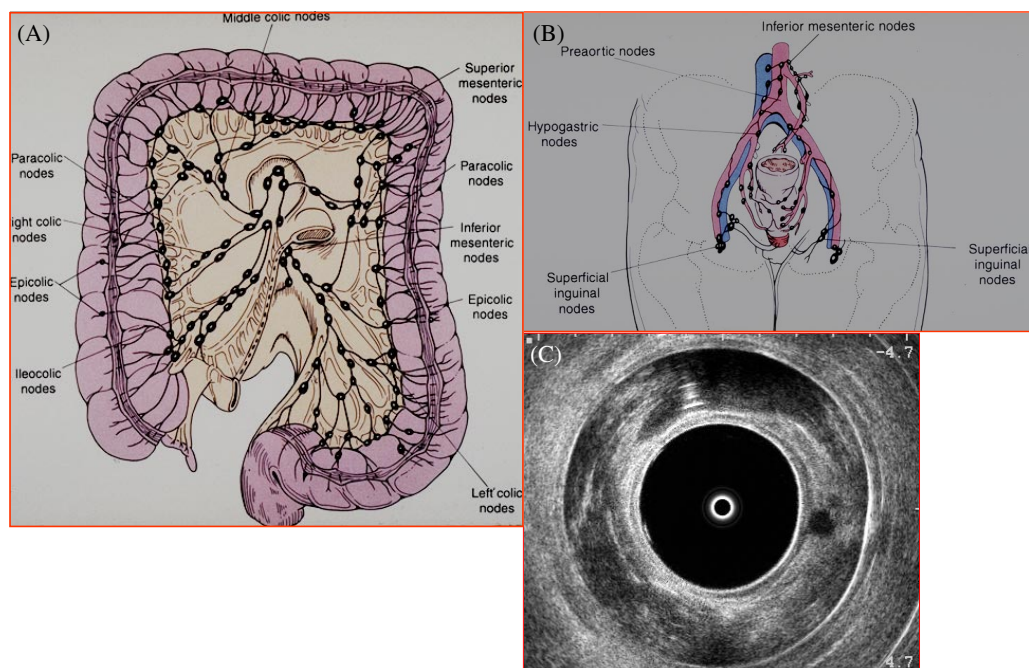
paramount importance in planning the surgical approach, in deciding whether neoadjuvant chemotherapy or radiation therapy is necessary, and in determining the risk of tumour recurrence and overall prognosis. The TNM staging scheme for colorectal cancer is shown in Table 1.

A number of imaging examinations have proven useful for colorectal cancer staging:

- (1) multidetector CT
- (2) MRI
- (3) endoluminal MRI
- (4) transabdominal ultrasound
- (5) transrectal ultrasound
- (6) intraoperative ultrasound
- (7) positron emission tomography (PET)
- (8) PET/CT.



**Figure 2** T staging of colorectal cancer. (A) Schematic drawing. T1, tumour extends into submucosa; T2, tumour extends into muscularis propria; T3, tumour extends through the muscularis propria into the subserosa; T4, tumour extends directly into other organs or tissues. (B) Transrectal ultrasound shows a T1 rectal cancer. (C) Axial MR image demonstrates a T2 rectal cancer. (D) CT shows a T3 cancer of the ascending colon.



**Figure 3** N staging of colorectal cancer. (A) Schematic diagram depicting the four levels of colonic lymph nodes. (B) Schematic diagram showing lymph node groups typically involved in rectal and anal cancer. (C) Transrectal ultrasound demonstrates a spherically shaped hypoechoic lymph node at 3 o'clock.

### *T-staging*

T staging (Fig. 2) assesses the depth of tumour invasion into the wall of the colon, surrounding serosa, fat, and adjacent organs. Transrectal ultrasound is superior to transrectal MR in depicting the depth of mural invasion for rectal neoplasms and both modalities are superior to MDCT and conventional MR. PET and PET/CT have only a limited role in this aspect of tumour staging.

### *N staging (Fig. 3)*

CT and MR detection of malignant lymphadenopathy has traditionally been based on size criteria. Lymph nodes greater than 1 cm are considered abnormal. Unfortunately size criteria are based only on statistical probability. In reality, many nodes smaller than 1 cm are malignant, and nodes larger than 1 cm are caused by reaction to a number of benign inflammatory conditions. Accordingly, CT and MR cannot reliably differentiate benign from malignant adenopathy.

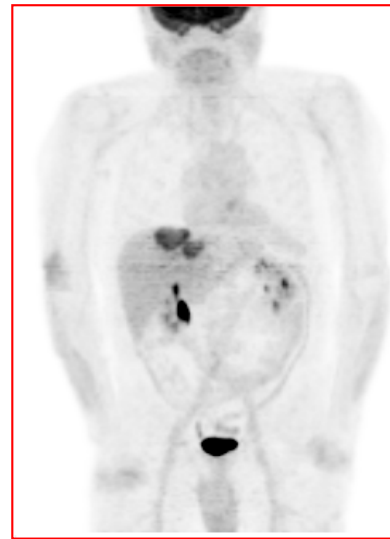
Transrectal ultrasound is superior to MDCT, conventional MR and transrectal MR in the depiction of local rectal adenopathy. PET/CT is superb for detecting regional and distant adenopathy.

### *M staging*

Once colorectal cancer has become invasive, there are five major routes of metastases that can be assessed with imaging: (1) direct invasion; (2) lymphatic permeation and dissemination; (3) venous embolization; (4) transperitoneal seeding; (5) intraluminal implantation.

MDCT is the standard means of M staging in most situations. It is superior to transabdominal ultrasound and MR in depicting omental, mesenteric and peritoneal disease. PET/CT appears to be the most accurate means of globally evaluating the chest and abdominal cavities for metastatic tumour. Intraoperative ultrasound appears

to be the most sensitive technique in the depiction of liver metastases (Fig. 4).



**Figure 4** PET scan showing metastatic disease to the liver.

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